



1 In the claims:

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4 38 (Previously presented) A power combiner having:  
5 a central axis about which is disposed a plurality k of  
6 cylindrical feed waveguides, each said feed waveguide having  
7 a radius, an input port and a launching port, all centered  
8 on a feed waveguide axis, said launching port including a  
9 cylindrical helix;

10 a plurality k of focusing reflectors, one for each said  
11 feed waveguide, each said focusing reflector centered on  
12 said feed waveguide axis;

13 a final waveguide coaxial to said central axis and  
14 collecting power reflected by each said focusing reflector  
15 with a proximal final waveguide reflector port.

16  
17 39 (Currently amended) The power combiner of claim 38  
18 where

19  $(1/n) \cdot \arccos \left( \frac{p}{X_{pq}} \right) \cdot \frac{(m/X_{mn})}{\dots}$  is an integer, when

20 said  $p$   $m$  = azimuthal wave number

21 said  $q$   $n$  = radial wave number

22 said  $X_{pq}$   $X_{mn}$  = the eigenvalue of the mode.

23  
24 40 (Previously presented) The power combiner of claim  
25 38 where said feed waveguide launch port helical section is  
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1 formed by sweeping a line of length  $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$   
2 at said radius from and parallel to said feed waveguide  
3 axis, where  $\theta$  is the angle in radians about said feed  
4 waveguide axis and said  $L_{\text{launch}}$  is the length of the helical  
5 cut.

6  
7 41 (Previously presented) The power combiner of claim  
8 38 where said final waveguide is a cylinder.

9  
10 42 (Previously presented) The power combiner of claim  
11 38 where said feed waveguide axis is parallel to said  
12 central axis.

13  
14 43 (Previously presented) The power combiner of claim  
15 38 where each said feed waveguide radius is equal to each  
16 other said feed waveguide radius.

17  
18 44 (Previously presented) The power combiner of claim  
19 38 where at least one said feed waveguide radius is  
20 different from any other said feed waveguide radius.

21  
22 45 (Currently amended) The power combiner of claim ~~38~~  
23 40 where each said feed waveguide helical section angle  $\theta = 0$   
24 is uniformly offset with respect to a plane from said  
25 central axis to said feed waveguide center axis.

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1  
2 46 (Currently amended) The power combiner of claim ~~38~~  
3 40 where each said feed waveguide helical section angle  $\theta = 0$   
4 is not uniformly offset with respect to a plane from said  
5 central axis to said feed waveguide center axis.

6  
7 47 (Previously presented) The power combiner of claim  
8 38 where said feed waveguide helical launch port has a  
9 helical cut depth

10 
$$L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$$

11 where

12  $k_{\text{par}}$  is the parallel, or axial wave number

13  $m$  is the azimuthal index of the mode in said feed  
14 waveguide

15  $n$  is the radial index of the mode in said feed  
16 waveguide

17  $X_{mn}$  is the eigenvalue of the mode

18  $k_{\text{perp}}$  is the perpendicular wave number.

19  
20 48 (Cancelled)

21  
22 49 (Previously presented) The power combiner of claim  
23 38 where said reflector is formed by a curve extruded along  
24 said central axis, said reflector curve comprising a locus  
25 of points.

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1  
2           50 (Previously presented) The power combiner of claim  
3 49 where said locus of points satisfies the following  
4 criteria for each given locus point:

5           where each said feed waveguide has a circular feed  
6 caustic and a feed caustic phase front, and said final  
7 waveguide has a circular final caustic and a final caustic  
8 phase front, for each point on said locus, a first line  
9 segment starting from said locus point, touching said feed  
10 caustic and ending on said feed caustic phase front, and a  
11 second line segment starting on said locus point, touching  
12 said final caustic and ending on said final caustic phase  
13 front:

14  
15           a) the path length of said first line segment added to  
16 said second line segment is a constant,

17           b) at each said locus point, an intersection point is  
18 defined by the intersection of said locus point and a line  
19 which is tangent to said reflector curve at said locus  
20 point, and a perpendicular line which is perpendicular to  
21 said tangent line at said locus point, said perpendicular  
22 line bisecting the angle formed by said first line segment  
23 and said second line segment.

1        51 (Previously presented) The power combiner of claim  
2        38 where each said  $k$  reflectors, has an angular extent  
3        about said central axis ~~is~~ of  $360/k$  degrees.

4  
5        52 (Currently amended) The power combiner of claim 38  
6        where each said ~~input waveguide~~ feed waveguide input port is  
7        coupled to a source of asymmetric traveling wave power, ~~said~~  
8        ~~input power traveling~~ which travels through each said feed  
9        waveguide, ~~reflecting~~ reflects from said reflector and is  
10       collected in said final waveguide.

11  
12       53 (Previously presented) The power combiner of claim  
13       38 where each said feed waveguide, each said reflector, and  
14       said final waveguide are electrically conductive.

15  
16       54 (Previously presented) The power combiner of claim  
17       38 where each said feed waveguide, each said reflector, and  
18       said final waveguide include an electrically conductive  
19       surface.

20  
21       55 (Currently amended) A power combiner comprising:  
22       a plurality  $k$  of feed waveguide cylinders, each said  
23       feed waveguide cylinder having a feed waveguide axis and a  
24       radius, and also having a launch end which includes a  
25       helical cut ramp;

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1 a cylindrical final waveguide having a central axis;  
2 a plurality said k of reflectors interposed between  
3 said feed waveguide launch end and said final waveguide,  
4 each reflector for directing wave energy from said feed  
5 waveguide cylinder to said final waveguide;  
6 where k is an integer greater than 1.

7  
8 56 (Currently amended) The power combiner of claim 55  
9 where

10  $(1/\pi) \arccos \left( \frac{p}{X_{pq}} \right) \frac{(m/X_{mn})}{\pi}$  is an integer, when  
11 said  $p$   $m$  = azimuthal wave number  
12 said  $q$   $n$  = radial wave number  
13 said  $X_{pq}$   $X_{mn}$  = the eigenvalue of the mode.

14  
15 57 (Previously presented) The power combiner of claim  
16 55 where said feed waveguide launch port helical section is  
17 formed by sweeping a line of length  $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$   
18 at said radius from and parallel to said feed waveguide  
19 axis, where  $\theta$  is the angle in radians about said feed  
20 waveguide axis and said  $L_{\text{launch}}$  is the length of the helical  
21 cut.

22  
23 58 (Previously presented) The power combiner of claim  
24 55 where said feed waveguide axis is parallel to said  
25 central axis.

1  
2        59 (Previously presented) The power combiner of claim  
3 55 where any said feed waveguide radius is equal to any  
4 other said feed waveguide radius.

5  
6        60 (Previously presented) The power combiner of claim  
7 55 where at least one said feed waveguide radius is  
8 different from any other said feed waveguide radius.

9  
10       61 (Previously presented) The power combiner of claim  
11 ~~55~~ 57 where each said feed waveguide helical section angle  $\theta$   
12  $=0$  is uniformly offset with respect to a plane from said  
13 central axis to said feed waveguide center axis.

14  
15       62 (Previously presented) The power combiner of claim  
16 ~~55~~ 57 where each said feed waveguide helical section angle  $\theta$   
17  $=0$  is not uniformly offset with respect to a plane from said  
18 central axis to said feed waveguide center axis.

19  
20       63 (Previously presented) The power combiner of claim  
21 55 where said feed waveguide helical launch port has a  
22 helical cut depth

23        $L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$

24 where

25        $k_{\text{par}}$  is the parallel, or axial wave number

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1         $m$  is the azimuthal index of the mode in said feed  
2 waveguide

3         $n$  is the radial index of the mode in said feed  
4 waveguide

5         $X_{mn}$  is the eigenvalue of the mode

6         $K_{\text{perp}}$  is the perpendicular wave number.

7  
8  
9        64 (Previously presented) The power combiner of claim  
10 55 where said reflector is formed by a curve extruded along  
11 said central axis, said reflector curve comprising a locus  
12 of points.

13  
14        65 (Previously presented) The power combiner of claim  
15 64 where said locus of points satisfies the following  
16 criteria for each given locus point:

17        where each said feed waveguide has a circular feed  
18 caustic and a feed caustic phase front, and said final  
19 waveguide has a circular final caustic and a final caustic  
20 phase front, for each point on said locus, a first line  
21 segment starting from said locus point, touching said feed  
22 caustic and ending on said feed caustic phase front, and a  
23 second line segment starting on said locus point, touching  
24 said final caustic and ending on said final caustic phase  
25 front:



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a) the path length of said first line segment added to said second line segment is a constant,

b) at each said locus point, an intersection point is defined by the intersection of said locus point and a line which is tangent to said reflector curve at said locus point, and a perpendicular line which is perpendicular to said tangent line at said locus point, said perpendicular line bisecting the angle formed by said first line segment and said second line segment.

66 (Previously presented) The power combiner of claim 55 where said plurality comprises k feed waveguides and k reflectors, and the angular extent of each said reflector about said central axis is  $360/k$  degrees.

67 (Currently amended) The power combiner of claim 55 where each said ~~input~~ feed waveguide is coupled to a source of asymmetric traveling wave power, said ~~input~~ wave power traveling through each said feed waveguide, reflecting from said reflector and ~~collected~~ collecting in said final waveguide.

1           68 (Previously presented) The power combiner of claim  
2   55 where each said feed waveguide, each said reflector, and  
3   said final waveguide are electrically conductive.

4  
5           69 (Previously presented) The power combiner of claim  
6   55 where each said feed waveguide, each said reflector, and  
7   said reflector waveguide include an electrically conductive  
8   surface.

9  
10          70 (Currently amended) A power combiner comprising:  
11          k feed waveguides, each said feed waveguide formed from  
12   a 4 sided polygon conductor comprising a rectangle having a  
13   width and height adjoining a triangle having same said  
14   height, said polygon then rolled into a cylinder with ~~an~~ a  
15   feed waveguide axis substantially parallel to said rectangle  
16   width thereby forming said feed waveguide, said feed  
17   waveguide having a feed waveguide radius about said feed  
18   waveguide axis and a feed waveguide launch end adjacent to  
19   said triangle;  
20          a cylindrical final waveguide having a central axis;  
21          a plurality said k of reflectors positioned between  
22   said k feed waveguides and said final waveguide input end;  
23          where k is greater than 1.

1           71 (Currently amended) The power combiner of claim 70

2   where

3            $(1/n) \arccos \left( \frac{p}{X_{pq}} \right) \frac{(m/X_{mn})}{X_{mn}}$  is an integer, when

4           said  $p$   $m$  = azimuthal wave number

5           said  $q$   $n$  = radial wave number

6           said  $X_{pq}$   $X_{mn}$  = the eigenvalue of the mode.

8           72 (Currently amended) The power combiner of claim 70

9   where said feed waveguide launch port helical section is

10   formed by sweeping a line of length  $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$

11   at said feed waveguide radius from and parallel to said feed

12   waveguide axis, where  $\theta$  is the angle in radians about said

13   feed waveguide axis and said  $L_{\text{launch}}$  is the length of the

14   helical cut.

16           73 (Previously presented) The power combiner of claim

17   70 where said feed waveguide axis is parallel to said

18   central axis.

20           74 (Previously presented) The power combiner of claim

21   70 where each said feed waveguide radius is equal to each

22   other said feed waveguide radius.

1        75 (Currently amended) The power combiner of claim 70  
2 where at least one said feed waveguide radius is different  
3 from any other said feed waveguide radius.

4  
5        76 (Currently amended) The power combiner of claim ~~70~~  
6 72 where each said feed waveguide helical section angle  $\theta = 0$   
7 is uniformly offset with respect to a plane from said  
8 central axis to said feed waveguide center axis.

9  
10       77 (Previously presented) The power combiner of claim  
11 ~~70~~ 72 where each said feed waveguide helical section angle  $\theta$   
12  $= 0$  is not uniformly offset with respect to a plane from said  
13 central axis to said feed waveguide center axis.

14  
15       78 (Currently amended) The power combiner of claim 70  
16 where said feed waveguide helical launch ~~port~~ end has a  
17 helical cut depth

$$L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$$

18 where

19  $k_{\text{par}}$  is the parallel, or axial wave number

20  $m$  is the azimuthal index of the mode in said feed  
21 waveguide

22  $n$  is the radial index of the mode in said feed  
23 waveguide

24  $X_{mn}$  is the eigenvalue of the mode  
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1            $K_{\text{perp}}$  is the perpendicular wave number.

2  
3           79 (Currently amended) The power combiner of claim 70  
4 where said reflector is formed by a curve extruded along  
5 said central axis, said reflector curve comprising a locus  
6 of points.

7  
8           80 (Currently amended) The power combiner of claim 79  
9 where said locus of points satisfies the following criteria  
10 for each given locus point:

11           where each said feed waveguide has a circular feed  
12 caustic and a feed caustic phase front, and said final  
13 waveguide has a circular final caustic and a final caustic  
14 phase front, for each point on said locus, a first line  
15 segment starting from said locus point, touching said feed  
16 caustic and ending on said feed caustic phase front, and a  
17 second line segment starting on said locus point, touching  
18 said final caustic and ending on said final caustic phase  
19 front:

20  
21           a) the path length of said first line segment added to  
22 said second line segment is a constant,

23           b) at each said locus point, an intersection point is  
24 defined by the intersection of said locus point and a line  
25 which is tangent to said reflector curve at said locus

1 point, and a perpendicular line which is perpendicular to  
2 said tangent line at said locus point, said perpendicular  
3 line bisecting the angle formed by said first line segment  
4 and said second line segment.

5  
6 81 (Previously presented) The power combiner of claim  
7 70 where said plurality comprises k feed waveguides and k  
8 reflectors, and the angular extent of each said reflector  
9 about said central axis is  $360/k$  degrees.

10  
11 82 (Currently amended) The power combiner of claim 70  
12 where each said ~~input~~ feed waveguide is coupled to a source  
13 of asymmetric traveling wave power, ~~said input power~~  
14 traveling through each feed waveguide, reflecting from said  
15 reflector and collected in said final waveguide.

16  
17  
18 83 (Previously presented) The power combiner of claim  
19 70 where each said feed waveguide, each said reflector, and  
20 said final waveguide are electrically conductive.

21  
22 84 (Currently amended) The power combiner of claim 70  
23 where each said feed waveguide, each said reflector, and  
24 said ~~reflector~~ final waveguide include an electrically  
25 conductive surface.